IN THE SPECIFICATION:

Page 10, amend the first full paragraph as follows:

An optical transmitter based on the space-to-time converter as shown in FIG. 3 (the transmitter portion of Figure 1) has been previously analyzed by Sun et al. ~~[see IEEE J. Quantum. Electron. 28:2251~~ Appl. Optics, 37, 2858 (1998). Using their analysis, an output temporal signal carrying the encrypted data can be derived. In the present invention, a complex value notation was introduced here simply because optical encryption generates complex data. A spatially collimated and temporally transformed limited optical pulse can be written as

$$s(t) = p(t - t_0)\exp(j\omega_0 t) \qquad \text{(Equation 5)}$$

wherein p(t) is the envelope of the pulse, $t_o$ is the time of the peak intensity, and $\omega_o$ is the central temporal angular frequency of the pulse. The temporal angular frequency distribution is calculated by taking the temporal Fourier transform of Equation 5:

$$S(\omega) = P(\omega - \omega_0)\exp\{-j(\omega - \omega_0)t_o\} \qquad \text{(Equation 6)}$$

wherein $P(\omega)$) is the temporal Fourier-transformed p(t).

page 12, amend the first full paragraph as follows:

The hereof description assumes that the encrypted signal $r_i$ (x), described in Equation 4, was sampled at an interval of $\Delta$ in the input plane. This data sampling was required to avoid any overlap

between adjacent data in the reconstructed spatial data at the receiver because of the point-spread function of spatial-temporal converters [as described in Appl. Opt. 37:2858 (~~1968~~ 1998)]. As mathematically described below, the spatial data after the transmission of spatial-temporal converters become broad at the receiver. The sampled encrypted signal is given by

$$\begin{aligned} r'_i(x) &= \sum_n r_i(x)\delta(x - n\Delta) \\ &= \sum_n A_i(x)\exp\{j\phi_i(x)\}\delta(x - n\Delta) \\ &= \sum_n A_i(n\Delta)\exp\{j\phi_i(n\Delta)\}\delta(x - n\Delta) \end{aligned} \qquad \text{(Equation 10)}$$

wherein $A_i(x) = |r_i(x)|$ and $\exp\{j\phi_i(x)\} = r_i(x)/|r_i(x)|$. A spatial Fourier transform of the encrypted input signal by lens L2 is given by

$$R_i(\eta) = \sum_n A_i(n\Delta)\exp\{j\phi_i(n\Delta)\}\exp\left(-j\frac{n\Delta\omega'}{cf}\eta\right) \qquad \text{(Equation 11)}$$

wherein $\omega' = 2\pi c/\lambda'$, $f$ is the focal length of lens L2, and $\lambda'$ is the wavelength of the light beam used to write the resulting hologram. This signal was recorded as the real-time hologram in a storage medium, such as a multiple-quantum-well photorefractive device or higher-order nonlinear material. A hologram was created by the encrypted data described in Equation 11 and a reference beam. Assuming that the hologram works as a grating with the transmittance of

$$t_i(\eta) = \sum_n A_i(n\Delta)\exp\{j\phi_i(n\Delta)\}\exp\left(-j\frac{n\Delta\omega'}{cf}\eta\right) \quad \text{(Equation 12)}$$

In which the effect of the carrier frequency of the hologram caused by the angle of the encrypted data and the reference beam was neglected.

Page 13, amend the third full paragraph as follows:

This optical field was diffracted again by a grating and is given by

$$\psi_5(X';\omega) = \sum_n A_i(n\Delta)\exp\{j\phi_i(n\Delta)\}\exp\left\{j\frac{\alpha n\Delta}{c}\frac{(\omega-\omega_0)\omega'}{\omega}\right\}w'\left(-X'-n\Delta\frac{\omega'}{\omega}\right) \quad \text{(Equation 15)}$$

wherein X' is the coordinate as shown in FIG. 3 and w'(X') is the pupil function of the grating projected onto the X' coordinate. The output temporal signal may be obtained by taking an inverse temporal Fourier transform of $\psi_5(X', \omega)S(\omega)$ that is written by

$$\begin{aligned} o_i(X',t) &= \int_{-\infty}^{\infty}\psi_5(X';\omega)S(\omega)\exp(-j\omega t)d\omega \\ &= \sum_n A_i(n\Delta)\exp\{j\phi_i(n\Delta)\}w'\left(-X'-n\Delta\frac{\omega'}{\omega_0}\right)p(t-t_0+n\delta t)\exp(j\omega_0 t) \end{aligned} \quad \text{(Equation 16)}$$

wherein $\delta t=(\alpha\Delta/c)\times(\omega'/\omega_0)$ .. To do this, the following approximation was used:

$$\frac{1}{\omega} = \frac{1}{\omega_0+\Delta\omega} = \frac{1}{\omega_0}\left(\frac{1}{1+\Delta\omega/\omega_0}\right) \approx \frac{1}{\omega_0}\left(1-\frac{\Delta\omega}{\omega_0}\right) \approx \frac{1}{\omega_0} \quad \text{(Equation 17)}$$

to derive Equation 16 because $\Delta\omega = (\omega - \omega_0) << \omega_0^2$ in a few hundreds femtosecond pulse and the center angular frequency of ~~$2\pi \times 10^{14}$~~ $6\pi \times 10^{14}$.

Page 15, amend the second full paragraph as follows:

In this instance, the time separation between the reference pulse and the nth data pulse is ~~nt~~ $n\delta t$. For purposes hereof, it is assumed that the thin hologram was created by the interference pattern between the reference pulse and the encrypted data pulse, provided that the optical power of the reference pulse is much larger than that of each data pulse. The third term of Equation 19 is used to reconstruct the spatially encrypted signal. A cw laser beam is incident at the hologram to read out the stored data. The reconstructed optical field was then spatially Fourier transformed by lens L3. When the pupil function of the grating and a beam width are large, i.e., $W(\eta) = \delta(\eta)$, the reconstructed signal at plane P6 is expressed by

$$\xi_i(x') = F\left[\sum_n A_i(n\Delta)\exp\{-j\phi_i(n\Delta)\}\left|P(\omega-\omega_0)\right|^2 \exp\{-j(\omega-\omega_0)n\delta t\}\right] \quad \text{(Equation 22)}$$

With Equations 9 and 17, Equation 22 is calculated as follows:

$$\xi_i(x') = \int_{-\infty}^{\infty} \sum_n A_i(n\Delta)\exp\{-j\phi_i(n\Delta)\} \left|P(-\omega_0\eta / f\alpha)\right|^2 \exp\{j\omega_0\eta n\delta t / f\alpha\}\exp\{-j2\pi x'\eta / \lambda'' f\} d\eta$$

$$= \sum_n A_i(n\Delta)\exp\{-j\phi_i(n\Delta)\}\exp\left\{-\frac{\alpha^2\left(\frac{1}{\lambda''}x' + n\frac{\Delta}{\lambda'}\right)^2}{4\omega_0^2\tau^2}\right\} \qquad \text{(Equation 23)}$$

wherein the Gaussian-shaped input pulse envelope written by p(t)=exp$(-t^2/2\tau^2)$is used and wherein $\tau$ is a pulse width, and $\lambda''$ is the wavelength of the cw laser beam. Equation 23 shows that each pixel is spread by a Gaussian function with a $1/e^2$ width of $w_d = 4\sqrt{2}\omega_0\tau\lambda''/\alpha$. This signal was used in the following decryption system (see FIG. 5).

Page 17, amend the third full paragraph as follows:

When $\omega_0 = 6\pi \times 10^{14}$, $\lambda'' = 1\mu m$, $\alpha = 1/\sqrt{2}$, and $\tau = 50 fs$,. ~~wd~~ $\underline{w_d}$, is 754 μm. If the sampling interval, $\Delta$, is smaller than the width of Gaussian distribution, ~~wd~~ $\underline{w_d}$, in Equation 23, the reconstructed spatial data overlap one another. Thus, the original data cannot be reconstructed when the overlap is large, even if the correct phase key in the decryption process is used.